Sandstorm Stoppers

**Introduction**

The hardest part in retrofitting project is tuning energy model to existing building in respect to specific energy consumption per component. Therefore, our work started with analyzing existing building energy consumption in respect to its location, size, typology, and HVAC system. The challenge was to gather enough information from data provided by ASHRAE and collecting other data such as weather, HVAC system efficiencies, and architectural design.

**Strategy**

Our target was to evaluate maximum possible energy generation from PV panel and then work from top to bottom to reduce energy consumption. We analyzed our results of existing building and found out that space heating and heating in general have highest thermal load which then dominates the energy consumption due to building envelope and use of electric resistance coils.

**Passive Energy Steps & Control System**

We broke down energy consumption per building zones such as SCF-01, SCF-04, SCF-03, & Admin Area. We improved the U-Value of windows, reduced the infiltration per façade area, and then reduced space heating setpoint for SCF from 16 °C to 15 °C.

**Lighting & HVAC System**

We modeled the building in RELUX software to reduce overall lighting power by using LED. We assumed lux levels from IES NA and CIBSE sources and reduce the peak kW by 50 % hence the total energy consumption.

HVAC System was the difficult part as it was difficult to tune our existing building energy consumption to metered data even when using worst EER values, and Fan Power. Our modeled existing building consumes 90% annual energy consumption compared to metered data.

**Office System**

We recommend replacing it with Package Outdoor Heat pump with backup electric resistance heating, energy recovery wheel, direct drive fans, and VFD. This results in reduction of energy consumption by approximately 76 %.

**Warehouse System**

We evaluated the existing flowrates and found them oversized which might be the case due to low humidity requirement. We recommend replacing existing RTU with latest Rooftop unit with CDQ wheel, replacing AHU-01 with similar system as AHU-03, replacing centrifugal fans to direct drive fans, and adding 3 stage electric resistance coil.

**Conclusion**

We reduced the energy consumption by 86% using passive and active design strategies without using renewable. Overall, our retrofit building consumes 94 % less energy but is not net zero. We recommend increasing Photo Voltaic Panel area by 100 % to achieve a net zero energy building.